



Facilities Development Manual

ORIGINATOR Director, Bureau of Highway Development		PROCEDURE 11-26-15
CHAPTER 11	Design	
SECTION 26	Roundabouts	
SUBJECT 15	Final Design	

In this phase final adjustments are made to all of the design elements of the roundabout.

Signing

The overall concept for roundabout signing is similar to general intersection signing. Proper regulatory control, advance warning, and directional guidance are required to provide positive guidance to roadway users. Locate signs where roadway users can easily see them when they need the information in advance of the condition. Signs should never obscure pedestrians, motorcyclists or bicyclists. Signing needs differ for urban and rural applications and for different categories of roundabouts. On connecting highways coordinate sign selection with the Regional Traffic Section and local agency to maintain consistency on the facility.

Relationship With the MUTCD

The Manual on Uniform Traffic Control Devices for Streets and Highways ([MUTCD](#)) and the Wisconsin Manual on Uniform Traffic Control Devices, govern the design and placement of signs. To the extent possible, this text follows the principles outlined in the 2003 MUTCD and the February 4, 2005 Wisconsin MUTCD supplement.

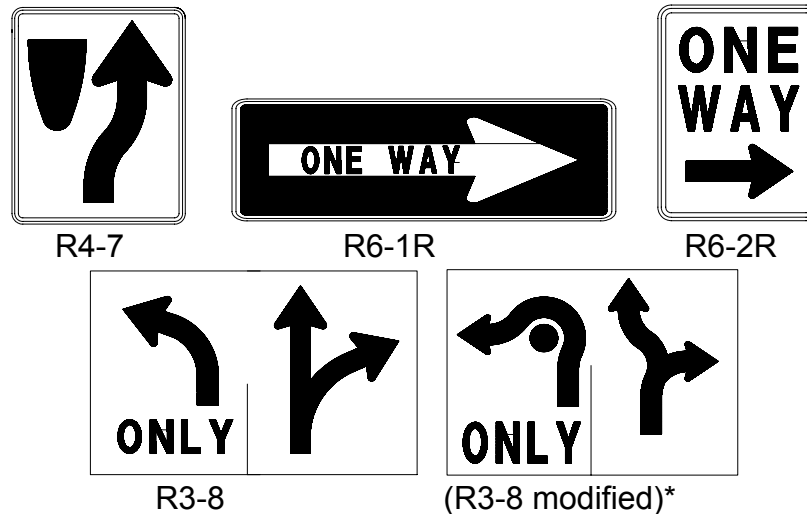
Regulatory Signs

A number of regulatory signs are appropriate for roundabouts and are described below.

1. Install a YIELD sign (R1-2) on both the left (in splitter island) and the right side of all approaches, single lane and multi-lane entrances, to the roundabout. During the first six months of operation of the roundabout, install 18" x 18" orange flags on top of the YIELD signs to emphasize the yield movement. Install a ONE WAY sign, R6-2R, under the left side yield sign on all approaches, single and multi-lane entrances, to the roundabout to establish the direction of traffic flow within the roundabout.
2. Install a ONE WAY sign in the central island opposite each entrance and mounted above the chevron sign (W1-8A) to emphasize the direction of travel within the circulatory roadway. Use the ONE WAY (R6-2R) on the STH system. The ONE WAY (R6-1R, size 3) may be used on the local system (local system includes connector routes). The R6-1R sign plate detail is available from the Bureau of Highway Operations, Traffic unit. The chevrons and the ONE WAY sign shall point in the same direction.
3. Install a KEEP RIGHT sign (R4-7) at the nose of raised curb splitter islands. The mounting height of the R4-7 ranges from 5-feet to 7-feet to the bottom of the sign. In

urban areas where pedestrians or bicyclists are expected to use the crosswalk it is recommended to use the 7-foot mounting. The Down Arrow, W12-1R, may be used but is less desirable for consistency and driver expectancy but may be mounted 2-feet to the bottom of the sign.

Lane-use signs such as the R3-8 sign are not used for single-lane entries. For multi-lane entries operational reasons will dictate where the R3-8 sign is used.



* The modified version of R3-8 is not in the MUTCD but is being tested at this time. The use of the modified R3-8 on the STH system requires a “request to experiment” so it is used on a consistent basis. Other states are experimenting with this sign.

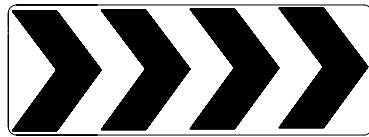
Warning Signs

A number of warning signs are appropriate for roundabouts and are described below. The amount of warning a motorist needs is related to site-specific intersection conditions and the vehicular speeds on approach roadways. The applicable sections of the MUTCD govern the specific placement of warning signs.

1. Install a circular intersection sign (“chasing arrows”, W2-6) on each approach in advance of the roundabout. Below the W2-6 sign, install ROUNDABOUT AHEAD educational sign, W2-6P, and below the W2-6P sign, install an advisory speed plate (W13-1). The speed given on the advisory speed plate should be no greater than the design speed of the circulatory roadway. Advisory speeds are posted in multiples of 5 mph.
2. Use a YIELD AHEAD sign (W3-2) on each approach to a roundabout. It shall be installed on an approach to a traffic control device (yield sign) that is not readily visible for a sufficient distance per Table 2C-4 of the 2003 MUTCD, Section 2C.26.
3. A chevron sign (series of 4 chevrons, W1-8a) shall be used in the central island opposite the entrances in combination with the ONE WAY sign (R6-2R on STH and the R6-1R may be used on the local system) addressed above. The mounting height to the bottom of the Chevron sign is 48-inches above existing ground [2A.18 MUTCD Wisconsin Supplement]. Specify the revised mounting height in the Special Provisions.
4. In urban areas install the pedestrian crossing and the ahead sign (W11-2 and W16-9P) in advance of the pedestrian crossing and arrow sign (W11-2 and W16-7L) approaching the roundabout and right-turn bypass lanes. Install the pedestrian

crossing sign (W11-2 and W16-7L) just in front of the crosswalk for approaching traffic and at the exit locations just in front of the crosswalk for approaching traffic also. Generally, rural roundabouts will not have pedestrian accommodations. However, if pedestrians are anticipated then the pedestrian signs referred to above are needed. If bicycle traffic is anticipated on the rural facility it may be appropriate to provide the short bicycle exit ramps just prior to the roundabout with a 6-foot path along the outside of the roundabout, with crossings similar to the urban layout and end at the bike entrance ramp. If the rural roundabout has a multilane entrance and you anticipate bicycle traffic on the facility bicycle exit/entrance ramps and crossings are required. Bicycle exit and entrance ramp angles with the roadway are shown in Procedure 11-26-1, Figure 1. The path in the rural area does not extend beyond the bicycle exit/entrance ramps. If the crosswalk at a roundabout is not considered to be part of the intersection and is instead considered a marked mid-block crossing, pedestrian crossing signs are required. A bicycle sign may be needed to designate the exit to the bike path (D11-1 and M7-1, Federal sign plate).

Locate pedestrian crossing signs in such a way to not obstruct the approaching driver's view of the YIELD sign or pedestrians standing at the crosswalk.



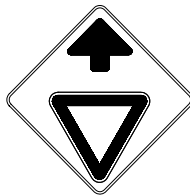
W1-8a



W2-6



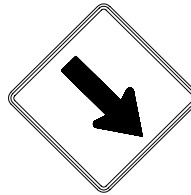
W2-6P



W3-2



W3-5



W12-1



W13-1

Guide Signs

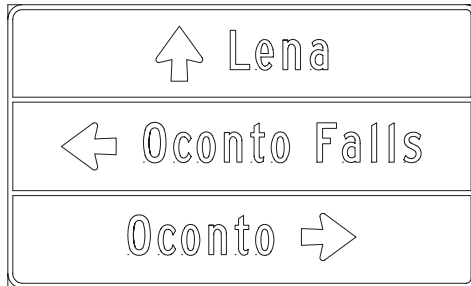
Guide signs provide drivers with needed navigational information. They are particularly needed at roundabouts since circular travel may disorient unfamiliar drivers. A number of guide signs are appropriate for roundabouts and are described below.

Use intersection destination signs in all rural locations and in urban/suburban areas where space allows and is appropriate. The diagrammatic style sign is preferred over the text style; examples of both are shown. The circular shape in a diagrammatic sign provides an important visual cue to all users of the roundabout. Diagrammatic signs are preferred because they reinforce the form and shape of the approaching intersection and make it clear to the driver how they are expected to navigate the intersection.

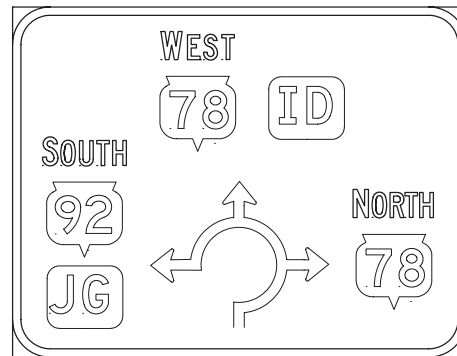
Reduce the lettering size and the STH or CTH shield size in urban areas to provide reading ability at 500 feet where posted speed is 45 mph, and 250 feet for 40 mph or less (see [Table 2C-4, 2003 MUTCD](#)). Lettering height rule of thumb is to provide approximately 1-inch in letter height for each 40-foot of distance from the sign. All capital letters are harder to read than the first letter capitalized with the following letters small case. Cardinal directions shall be all capital letters with the first letter slightly larger. There are examples of each shown below. Intersection destination signs may not be necessary at local street

roundabouts or in urban settings where there are no significant destinations and the majority of users are familiar with the site.

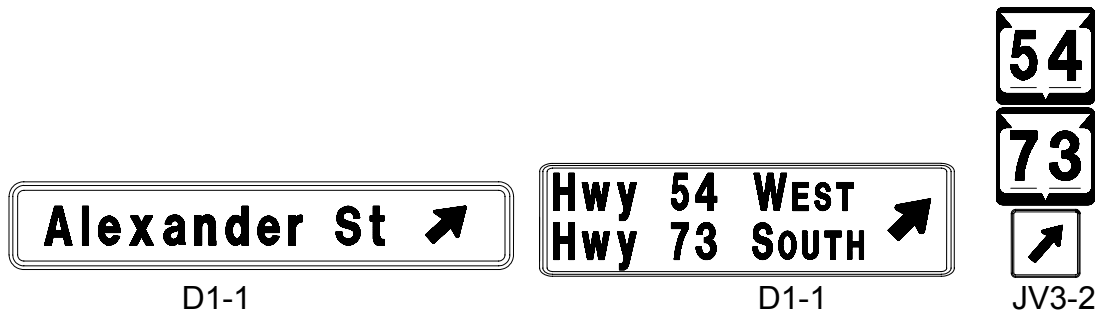
Text example



Diagrammatic example



Exit guide signs reduce the potential for disorientation. Use them to designate the destinations of each exit from the roundabout. These signs are conventional intersection direction signs (D1-1 or D3-1). They include an arrow slanted up and to the right, or directional route marker assemblies and placed in the splitter island facing the circulating traffic. The mounting height is to be a minimum of 60-inches from the ground to the bottom of the sign. Specify the revised mounting height in the special provisions.



Junction Assemblies

As with traditional intersections, consider using junction assembly consisting of either a “JCT” (M2-1) auxiliary sign with the appropriate route markers or a junction (J1-1) assembly in advance of the roundabout.

Route Confirmation Signs

For roundabouts involving the intersection of one or more numbered routes, install confirmation assemblies (J4's) directly after the roundabout exit to reassure drivers that they have selected the correct exit at the roundabout. Locate confirmation assemblies no more than 500 feet beyond the intersection in urban or rural areas. If possible, locate the assembly's close enough to the intersection so drivers in the circulatory roadway can see them.

Urban Signing Considerations

Urban intersections tend to exhibit lower speeds and drivers may have some familiarity with the street system. Consequently, the designer can, on a case-specific basis, consider using fewer and smaller signs in urban settings than in rural settings. Also, in some cases,

the designer can consider eliminating the intersection destination signs unless there is a specific destination(s) warranting them. However, include some indication of street names in the form of exit guide signs or standard street name signs. Also review proposed signing to ensure that sign clutter will not reduce its effectiveness. Avoid sign clutter by prioritizing signing and eliminating or relocating lower priority signs. A sample signing plan for an urban application is shown in [Figure 1](#).

Rural and Suburban Signing Considerations

Rural and suburban signing needs to be more conspicuous than urban signing due to higher approach speeds. Route guidance emphasizes destinations and numbered routes rather than street names. The exit guide sign needs to be visible (but discrete) from within the roundabout and much smaller than the typical rural shields and lettering size. Six inch upper case and 4-1/2 inch lower case lettering height is the maximum needed. A sample signing plan for a rural application is shown in [Figure 2](#).

Regulatory speed reduction may be considered when introducing a traffic control treatment on a rural facility. See FDM 11-26-1 “Speed Zone Declarations” for additional guidance. It may be appropriate to provide a REDUCE SPEED AHEAD (W3-5) sign approximately 500 feet in advance of the regulatory sign that reduces speed from 55 mph to 45 mph. The 45 mph posted speed sign (R2-1) is placed in advance of the circular intersection sign.

Short Term Awareness Techniques Some of the following bullet items are listed as short-term awareness techniques and others are mitigation considerations after field problems have been identified. In either situation contact the Regional Traffic Engineer for guidance. Do not expect traffic control devices to accomplish what the geometric design cannot. Large advance warning signs.

- Add flashing beacons to approach warning signing.
- Use of electrically operated speed warning signs. These can be triggered by speeds exceeding an acceptable threshold.
- Provide portable changeable message signs.
- Install orange flags on top of the YIELD signs during the first six months of operation.

Pavement Marking

Typical pavement marking for roundabouts consists of delineating the entries and marking the circulatory roadway on multi-lane roundabouts. Single lane roundabouts need no lane arrows or circulatory roadway pavement marking, except for edge line marking. Bike lane marking within the circulatory roadway is not permitted on any roundabouts. Pavement marking is needed on multi-lane roundabouts. The more complex the roundabout and the higher the volume, the greater is the need for proper pavement marking. Pavement marking must be closely evaluated when designing a roundabout. Pavement marking is part of a “whole system” to consider, meaning that various design concepts from geometric design, to signing, and pavement marking should compliment each other.

The [MUTCD](#) provides pavement marking guidelines and standards. Applicable local standards may also govern the design and placement of pavement marking as long as they do not conflict with the MUTCD and WisDOT policies. Roundabouts present a number of new pavement marking issues that are not addressed in the 2003 MUTCD or the FHWA roundabout guide. For this reason, new pavement marking concepts and widths as well as existing pavement markings are shown in this guidance. On connecting highways

coordinate pavement marking with the Regional Traffic Section and the local agency to maintain consistency on the facility.

Approach and Entry Pavement Markings

Approach and entry pavement markings consist of channelization marking, dotted edge line extension marking, yield line and symbol markings.

Approach marking

Pavement marking adjacent to the splitter island shall be 4-inch yellow along the left edge of entrance and exit areas for single and multi-lane roundabouts. Right edgeline, if used, is 4-inch white. It is important to separate the lanes on multi-lane entrances. To do this it may be appropriate to provide either 4-inch or 8-inch white channelizing line just prior to the yield point to assist in lane utilization. When space is allowed, a 4-inch or 8-inch white equal line, gap just prior to and matches the width of the 4-inch or 8-inch channelizing line is optional. See additional pavement marking guidance in the Traffic Guidelines Manual, Section 3-2-24 ([WisDOT link](#)) (non-[WisDOT link](#))

Provide minimum 6-inch wide crosswalk pavement marking where pedestrian traffic is expected.

The edgeline adjacent to the splitter island along the right edge of the circulatory roadway is 8-inch white. The dotted edgeline extension used to demarcate the entry approach from the circulatory roadway is 12-inches wide for single lane entries with less than 15,000 total AADT entering the roundabout with a 3 ft line, 3 ft gap and located along the inscribed circle. The dotted edgeline extension is 16-inches wide for all multi-lane entries, and for single-lane entries when the total AADT entering the roundabout is 15,000 or greater. Provide a 3-ft line and 3-ft gap located along the inscribed circle. Set the dotted edge line extension slightly back from the circulating roadway to prevent circulating traffic from scuffing the markings. Do not place pavement marking to demarcate the exit from the circulatory roadway.

Single lane entrances have no lane markings at the entrance. Multi-lane entries typically require lane assignment, which sometimes is critical to provide maximum capacity and safety. The approach lane markings are based on the entry volume and projected turning movements.

Assume that one leg of an approach on a 4-leg roundabout flares to two lanes. The flare must be developed uniformly and avoid any sharp curb break as the flare starts. When the flare widens from a single lane to 19 ft (centerline or inside curb face to outside curb face), begin the pavement marking to form two lanes as shown in [Figure 3](#). The skip-dash or solid white lane line pavement marking leading up the yield point divides the approaching traffic into two lanes.

In addition to approach lane markings, appropriate lane arrows encourage balanced lane use, which improves capacity and safety. Left turn arrows are very important on multi-lane approaches. Traffic often has a bias towards the right-most lane. Lane arrows either encourage this bias, or can encourage better lane utilization. Lane arrows can be complex with subtle problems that can reduce capacity and cause crashes, so great care and understanding is needed. [Figure 4](#) shows the use of pavement marking arrows that assist lane utilization in advance of the roundabout yield point. Lane utilization becomes even more important at 3- and 4-lane entries. The beginning of the skip dash pavement marking is intended as a visual cue to drivers to select an appropriate lane for entering the roundabout. It should not be considered lane width marking because the flare is widening at this point.

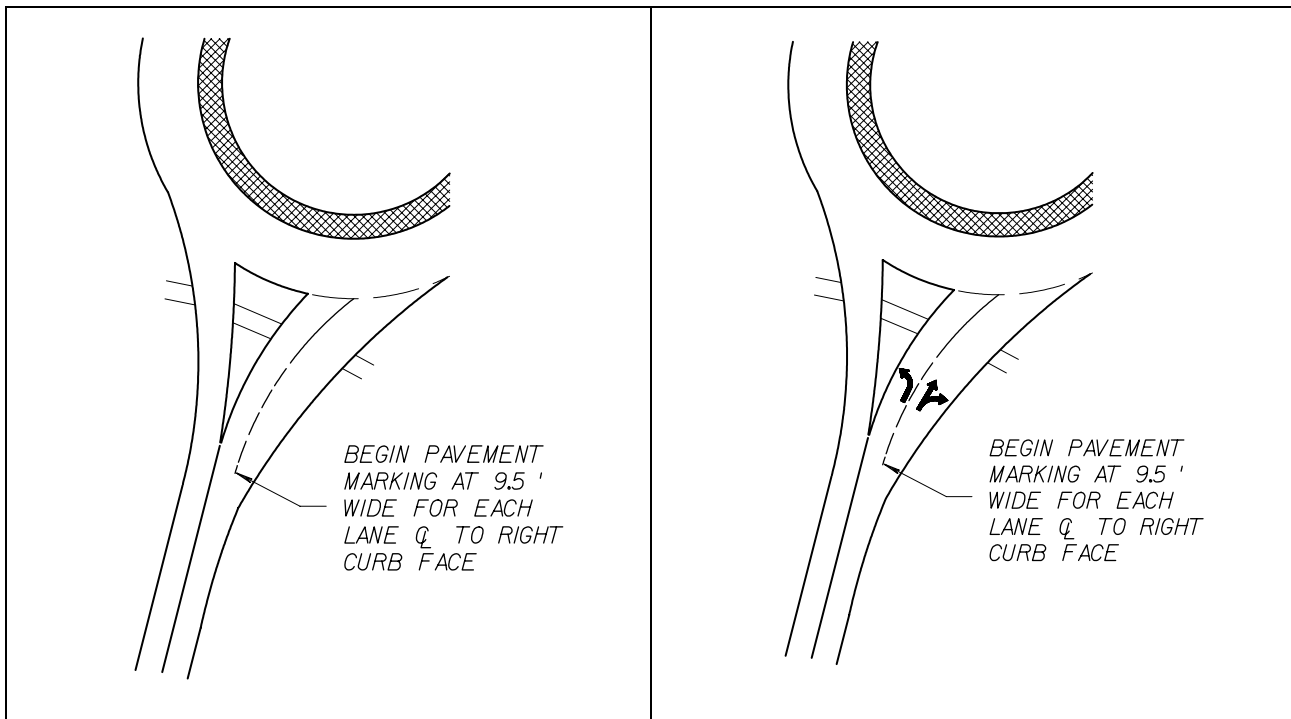
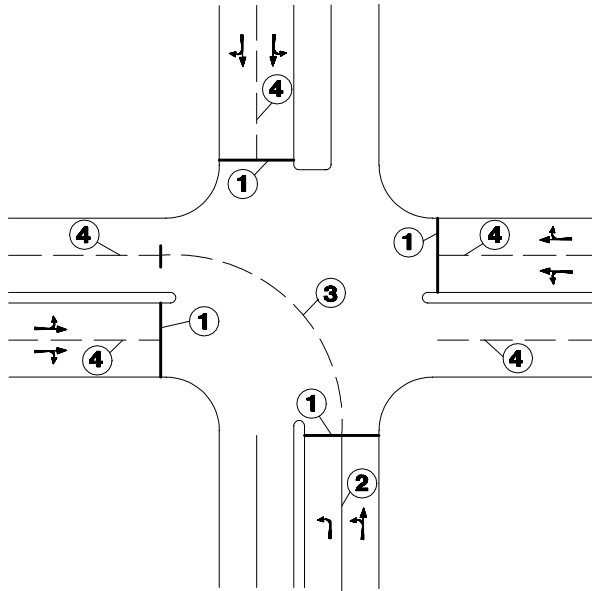
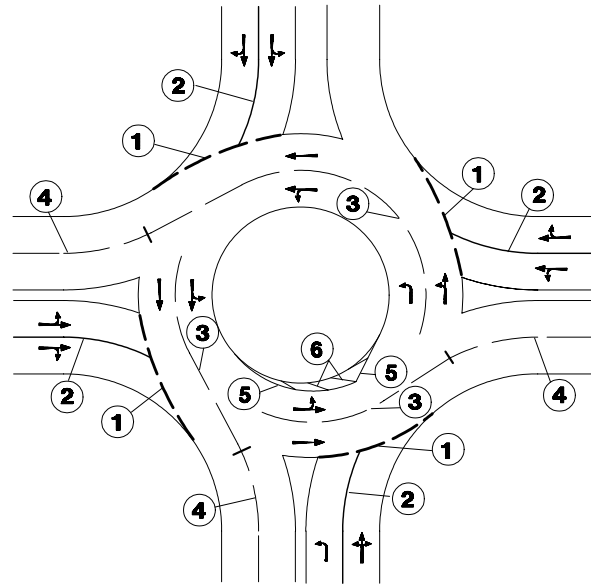
Figure 3 Figure 4

Figure 5 and Figure 6 show the similarity of dual left turn lane marking between a signalized intersection and a roundabout. The approach arrows shown are only an example. Final arrow type depends on internal roundabout lane functions.

Figure 5 Double left turn at signal**Figure 6 Double left turn at Roundabout**

Notes for Figure 5	Notes for Figure 6
① 18-inch solid white	① Line width varies see Figure 7
② 8-inch solid white	② 8-inch solid white, 50 foot minimum or to PC when one of the lanes is designated as a turn lane. 4-inch when both lanes are through lanes.
③ 8-inch white, 3-foot line, 6-foot gap	③ 4-inch or 8-inch white, 6-foot line, 3-foot gap. Equal line, gaps are dependent on discussion with the Regional Traffic Engineer.
④ 4-inch white, 12 ½-foot line, 37 ½-foot gap	④ 4-inch white, 12 ½-foot line, 37 ½-foot gap. A maximum of 12-foot equal line, gaps are dependent on discussion with the Regional Traffic Engineer.
	⑤ 8-inch solid yellow
	⑥ 12-inch solid yellow, 10 foot on center

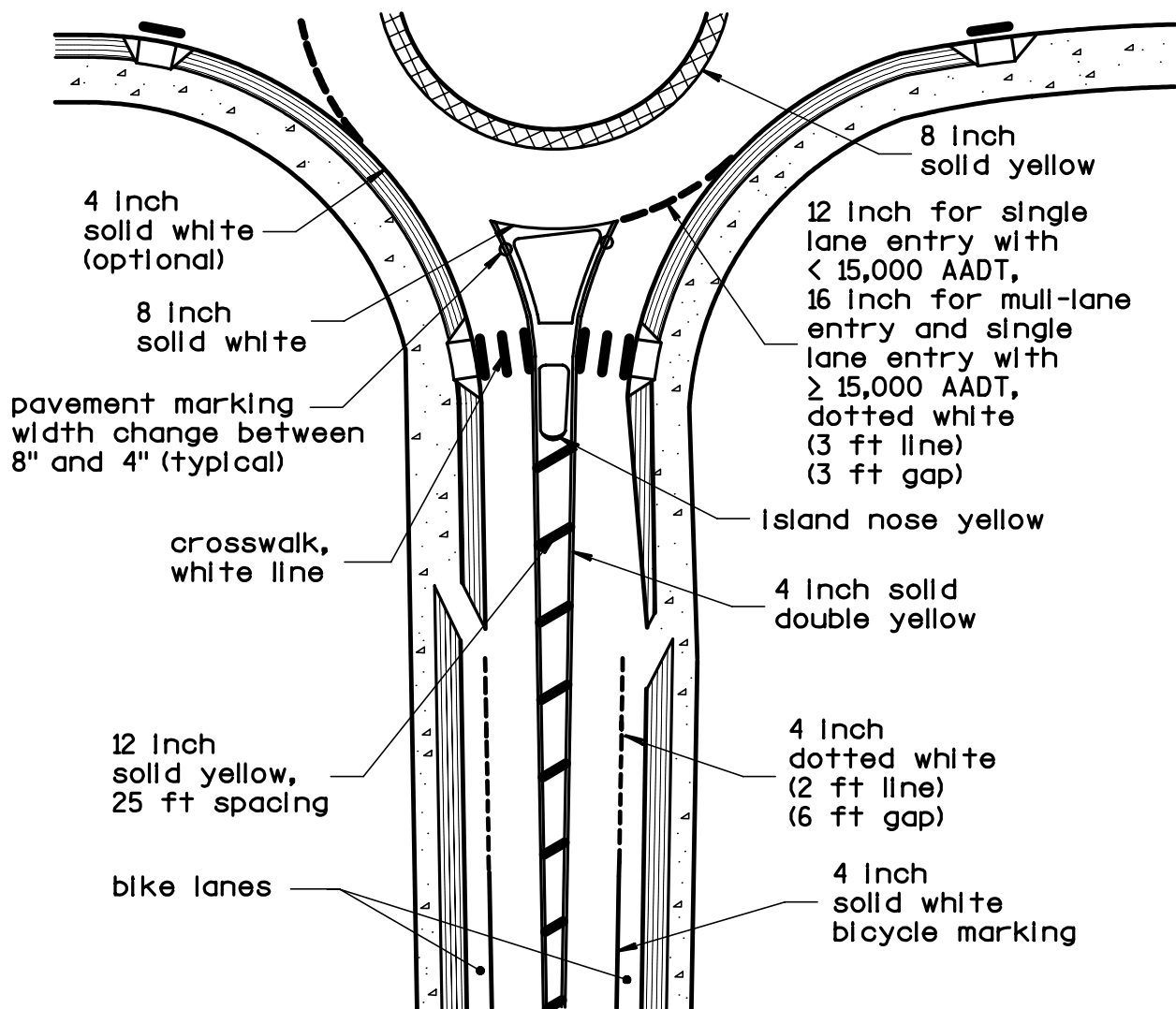
Entrance emphasis pavement marking

Pavement word or symbol markings to supplement the signing and yield point marking may be desirable, consult with the Regional Traffic Engineer for further guidance. These markings should conform to the standards given in 2003 MUTCD, Section 3B.19. Install chevrons 12-inches wide on 10-foot centers as shown in the TGM 3-2-24 if the gore area near the splitter island adjacent to the circulatory roadway is fairly large.

If higher emphasis is needed to identify the yield point it may be appropriate to use yield line marking consisting of a series of white triangles (known as "shark's teeth" 2003 MUTCD, Section 3B.16) located in advance of the dotted edgeline extension marking.

Figure 7 shows pavement markings for a typical roundabout entrance and exit.

Figure 7. Typical Roundabout Pavement Marking

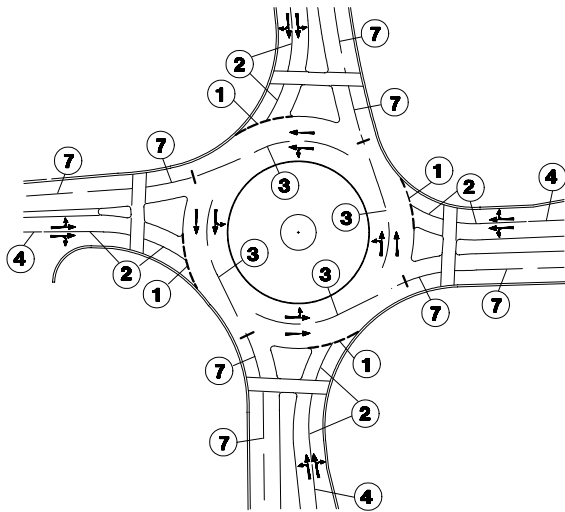
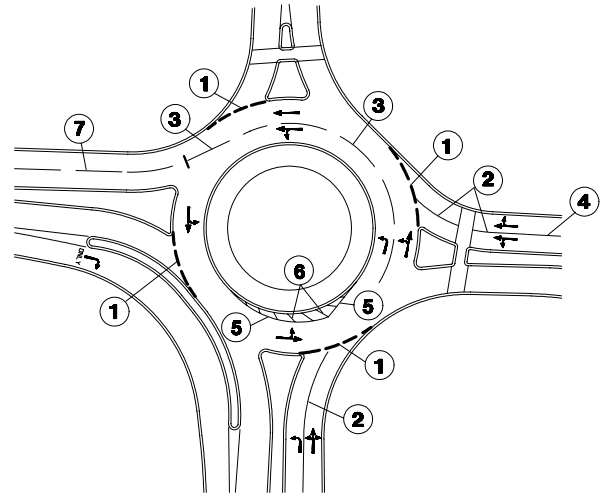
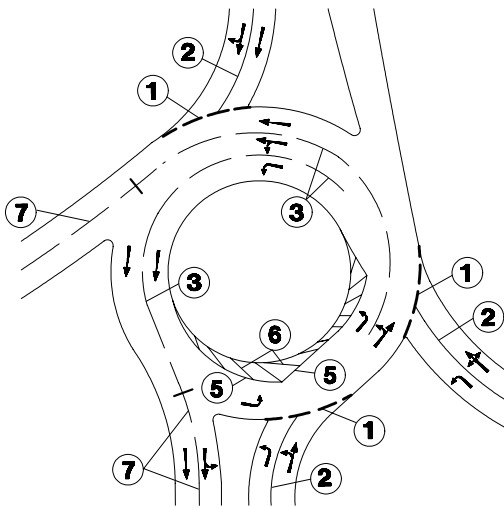
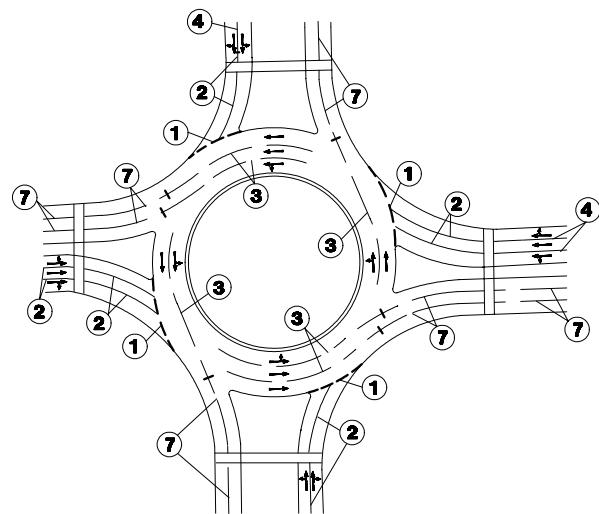


Circulatory Roadway Pavement Marking

Circulatory pavement markings apply only to roundabouts with multi-lane entrances. These markings consist of arrows, spiral striping, and, on rare occasions, skip-dash channelizing lines. Never use concentric circle pavement marking on the circulatory roadway. All movements must be traced through the roundabout to avoid conflicts in the same peak and to avoid conflicts between peaks. This task is not easy and must be reviewed by an experienced roundabout designer and the Regional Traffic Engineer.

Circulatory roadway arrow marking is important to educate US drivers and encourage correct lane usage. Circulatory roadway spiral pavement marking adjacent to the central island requires considerable engineering judgment to design and locate properly. As can be seen in Figures 9 and 10, spirals can be used to reduce the circulatory pavement width and direct traffic into the appropriate lane. It is just as important to make sure field layout and pavement marking application on the circulatory pavement is located and positioned correctly. A pavement marking layout detail showing the exact locations is required. Consider wheel tracking when developing the pavement marking layout detail. Consider high durability marking for the dotted edgeline extensions and marking within the circulatory roadway. The spirals may have to be applied with hand application rather than with a truck application. If the designer determines that hand application is required it must be specified in the special provisions. Proper pavement marking within the circulatory roadway will help prevent left turns from the outer lane and thus reduce exit crashes.

Figures 8 to 11 show example pavement marking of various common design types. These are examples only and specific marking for each roundabout may be different.

Figure 8 Normal two-lane roundabout**Figure 9 Heavy right turn bypass lane and double left turn lane****Figure 10. Diamond interchange, heavy lefts from exit ramp and lower approach (consecutive double lefts)****Figure 11 Normal 2-3 lane roundabout****Notes for Figure 8 through 11**

- ① Line width varies see Figure 7
- ② 8-inch solid white, 50 foot minimum or to PC when one of the lanes is designated as a turn lane. 4-inch when both lanes are through lanes.
- ③ 4-inch or 8-inch white, 6-foot line, 3-foot gap. Equal line, gaps are dependent on discussion with the Regional Traffic Engineer.
- ④ 4-inch or 8-inch white, 12 ½-foot line, 37 ½-foot gap. Equal line, gaps are dependent on discussion with the Regional Traffic Engineer.
- ⑤ 8-inch solid yellow spiral marking
- ⑥ 12-inch solid yellow, 10 foot on center spiral marking
- ⑦ 4" white, 12 ½-foot line, 37 ½-foot gap. A maximum of 12-foot equal line, gaps are

dependent on discussion with the Regional Traffic Engineer.

Illumination

A driver must be able to perceive the general layout and operation of an intersection in time to make appropriate maneuvers. Whenever a facility is designed for use by several user groups (motor vehicles, pedestrians and bicycles or mopeds), the roundabout must be illuminated. Therefore, adequate lighting needs to be considered at all roundabouts. Additional illumination guidance is in the Traffic Guidelines Manual, Procedure 11-11-1 ([WisDOT link](#)) (non-[WisDOT link](#)).

Need for Illumination

The need for illumination varies depending on the location of the roundabout.

Urban Conditions

Illuminate urban roundabouts if all or most of the approaches are illuminated and where necessary to improve the visibility of pedestrians and bicyclists. If the designer's goal is to emphasize the role of this facility as a transition speed zone, illumination becomes an important asset.

Suburban Conditions

In general, illumination is beneficial and needs to be considered for all suburban roundabouts. Illumination is particularly recommended for safety reasons when any of the following conditions are present.

- One or more approaches are illuminated.

- Competing non-roadway illumination in the vicinity can distract the driver's attention (i.e. highly illuminated parking lots, car lots or filling stations).

- Heavy nighttime traffic is anticipated.

- Pedestrian traffic is anticipated (approaches have sidewalks).

Provide continuity of illumination level between approaches and the roundabout itself to avoid distracting drivers and to minimize the need for the driver's eye to adjust to changing lighting levels.

Rural Conditions

Illumination may be considered for rural roundabouts but it is not mandatory. Illumination would be costly if there is no power supply near the intersection. If lighting is not provided, then make sure the intersection is well signed and marked so that it can be correctly perceived by day and night. Use reflective pavement marking and retroreflective signs (including chevrons supplementing the ONE-WAY signs) regardless of whether illumination is provided. Reflectivity shall conform to the Standard Specifications.

Where illumination is provided, illuminate any raised channelization or curbing. In general, provide a gradual illumination transition zone of approximately 250 feet beyond the final trajectory changes at each exit. This helps drivers adjust their vision back into the dark environment of the exiting roadway, which takes approximately 1 to 2 seconds. In addition, avoid short-distance dark areas between two consecutive illuminated areas.

Standards and Recommended Practices

Category I: Illumination of new or temporary roundabouts where existing adjacent roadways are not illuminated or current illumination of adjacent roadways is below standard.

Generally, the illumination levels of conventional intersections should be approximately equal to the sum of the illumination levels of the intersecting roadways.

The basic principle behind the lighting of roundabouts in urban and suburban areas is that the amount of light on the intersection should be proportional to the light provided on the intersecting streets and equal to the sum of the values used for each separate street.

WisDOT recommends a simplified approach to street illumination, which is to design illumination for asphaltic pavement surface conditions. Illumination recommendations for concrete pavement will generally not be considered on the state trunk highway system. For roundabouts, WisDOT will use the information presented in Table 1 and Table 2 to determine the design level of illumination (computed using Table 3) rather than the existing light levels of the streets that approach the roundabout.

Design the roundabout to have the illumination levels given in Table 1. This would result in illumination levels at the roundabout ranging from 8 lux (0.7 fc) for roundabouts at the intersection of two local streets with low pedestrian traffic volume (two intersecting local streets each having an illumination level of 4 lux, the resulting sum is 8 lux), to 34 lux (3.4 fc) for roundabouts at the intersection of two major streets with high pedestrian traffic volume. Table 2 provides a description of roadway classification with related volumes and pedestrian conflict area classification with related volumes. Complete the form in Table 3 to determine the intersection illumination level.

Table 1. Illuminance Levels at Roundabouts and Other Intersections.

Recommended Illuminance for Intersections				
Roadway Classification (Street A/Street B)	Average Maintained Illuminance at Pavement ¹			Uniformity Ratio (E _{avg} /E _{min}) ²
	Pedestrian/Area Classification			
	High lux (fc)	Medium lux (fc)	Low lux (fc)	
Major/Major	34.0 (3.2)	26.0 (2.4)	18.0 (1.7)	3.0
Major/Collector	29.0 (2.7)	22.0 (2.1)	15.0 (1.4)	3.0
Major/Local	26.0 (2.4)	20.0 (1.9)	13.0 (1.2)	3.0
Collector/Collector	24.0 (2.2)	18.0 (1.7)	12.0 (1.1)	4.0
Collector/Local	21.0 (2.0)	16.0 (1.5)	10.0 (0.9)	4.0
Local/Local	18.0 (1.7)	14.0 (1.3)	8.0 (0.7)	6.0

¹ fc = foot candles (conversion factor from lux to foot candles is 10.67).

fc has been rounded to the nearest tenth)

² E_{avg} = Horizontal Illuminance, E_{min} = Vertical Illuminance

Source: ANSI / IESNA RP-8-00 Table 9

Values in Table 1 assume typical asphalt roadway surface. WisDOT will not use different pavement classifications to determine illumination levels.

Table 2. ANSI/IESNA RP-8-00 Guidance for Roadway and Pedestrian/Area Classification For Purposes of Determining Intersection Illumination Levels

Roadway Classification	Description	Existing Daily Vehicular Traffic Volumes¹
Major	That part of the roadway system that serves as the principal network for through-traffic flow. The routes connect areas of principal traffic generation and important rural roadways leaving the city. Also often known as “arterials,” thoroughfares,” or “preferentials.”	Over 3,500 ADT
Collector	Roadways servicing traffic between major and local streets. These are streets used mainly for traffic movements within residential, commercial, and industrial areas. They do not handle long, through trips.	1,500 to 3,500 ADT
Local	Local streets are used primarily for direct access to residential, commercial, industrial, or other abutting property.	100 to 1,500 ADT
Pedestrian Conflict Area Classification	Description	Guidance on Existing Pedestrian Traffic Volumes²
High	Areas with significant numbers of pedestrians expected to be on the sidewalks or crossing the streets during darkness. Examples are downtown retail areas, near theaters, concert halls, stadiums, and transit terminals.	Over 100 pedestrians/hour
Medium	Areas where lesser numbers of pedestrians use the streets at night. Typical are downtown office areas blocks with libraries, apartments, neighborhood shopping, industrial, older city areas, and streets with transit lines.	11 to 100 pedestrians/hour
Low	Areas with very low volumes of night pedestrian usage. These can occur in any of the cited roadway classifications but may be typified by suburban single-family streets, very low-density residential developments and rural or semi-rural areas.	10 or fewer pedestrians/hour

¹ For purposes of intersection lighting levels only

² Pedestrian volumes during the average annual first hour of darkness (typically 6:00 pm-7:00 pm) representing the total number of pedestrians walking on both sides of the street plus those crossing the street at non-intersection locations in a typical block or 200 m (656 ft) section. RP-8-00 clearly specifies that the pedestrian volume thresholds presented here are a local option and should not be construed as a fixed warrant.

Table 3. Roundabout Illumination Determination Form

Intersection Information	
Location: _____	
Street Name A: _____	ADT: _____
Street Name B: _____	ADT: _____
Pedestrian Count: _____ (See Table 2)	
Roadway Classification	
Street A Classification: _____ (Major, Collector, Local from Table 2)	
Street B Classification: _____ (Major, Collector, Local from Table 2)	
Pedestrian Classification: _____ (High, Medium, Low from Table 2)	
Determine Illumination Level	
Use information from Roadway Classification above and go to Table 1 to select appropriate illumination level.	
Illumination Level: _____	Uniformity Ratio: _____

Category II: Illumination of new or temporary roundabouts where existing adjacent roadways are illuminated and meet the AASHTO Informational Guide to Roadway Lighting (1984, Table 3 values).

The roundabout illumination level shall be equal to the sum of the illumination values used/available for each individual street. For example if Street A has existing illumination level x and Street B has an existing illumination level of y , then illuminate the roundabout at a level of $x+y$.

If the existing roadways do not meet the AASHTO roadway lighting levels, then use the lighting criteria specified in Category I.

General Recommendations

The primary goal of illumination is to avoid surprising drivers by enabling them to see and navigate the geometric features and the deflection of the roundabout and the approach geometry and traffic control. Lighting also facilitates mutual visibility among the various users. To achieve this, the following features are recommended:

- Provide good illumination on the approach nose of the splitter islands, at all conflict areas where traffic is entering the circulating stream, and at all places where the traffic streams separate to exit the roundabout.
- Light the roundabout from the outside in towards the center to improve the visibility of the central island and the visibility of circulating vehicles to vehicles approaching to the roundabout. Avoid lighting from the central island outward since vehicles become shadows against the light, and thus, less visible. If it is desired to illuminate specific objects in the central island, use ground-level lighting within the central island that shines upwards towards the objects and away from the nearest roadway. Always put accent lighting on separate electrical disconnects from roadway lighting for the purpose of blackout protection.
- Consider lighting pedestrian crossing and bicycle merging areas.

Clear Zone Requirements

The position of lighting poles relative to the curbs at a roundabout is governed in part by the speed environment in which the roundabout is located and the potential speeds of errant vehicles that can be reasonably expected. Refer to FDM, [Procedure 11-15-1](#) for more information on clear zone, lateral clearance and horizontal clearance. Refer to FDM, [Procedure 11-45-1](#) and the AASHTO *Roadside Design Guide* for information on roadside safety. Avoid placing lighting supports and other poles or hazards within the splitter islands or on the right-hand perimeter just downstream of an exit point. Avoid placing light poles in the central island.

Illumination References

AASHTO, *An Information Guide for Roadway Lighting*. This is the basic guide for highway lighting. It includes information on warranting conditions and design criteria. AASHTO Bookstore item code GL-5.

AASHTO, *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*. This specification contains the strength requirements of the poles and bracket arms for various wind loads as well as the frangibility requirements. All luminaire supports, poles, and bracket arms must comply with these specifications. AASHTO Bookstore item code LTS-4-M.

ANSI / IESNA RP-8-00: *American National Standard Practice for Roadway Lighting*. This Recommended Practice, published by the Illuminating Engineering Society of North America provides standards for average maintained illuminance, and small target visibility, as well as uniformity of lighting.

Centre d'Etudes sur les Reseaux les Transport. L'Urbanisme et les constructions publiques (CERTU), L'Eclairage des Carrefours a Sens Giratoire (The Illumination of Roundabout Intersections), Lyon, France: CERTU, 1991.

Landscaping

Landscaping is vital to the proper operation of a roundabout, and needs to be in place when the roundabout is opened to traffic. The purposes of landscaping are to:

- Make the central island conspicuous to drivers as they approach the roundabout.
- Clearly indicate to drivers that they cannot pass straight through the intersection.
- Discourage pedestrian traffic through the central island.
- Help blind and visually impaired pedestrians locate sidewalks and crosswalks.
- Improve the aesthetics of the area while complementing surrounding streetscapes as much as possible.

When designing landscaping for a roundabout it is important to:

- Minimize introducing fixed objects such as trees, poles, walls, guard rail, statues, or large rocks in the approach to the intersection.
- Avoid obscuring the form of the roundabout or the signing to the driver.
- Maintain adequate sight distances.

Central Island Landscaping

Landscape the central island by adding shrubs or trees on the interior of the island. This will make the island more conspicuous and will usually enhance the safety of the intersection by causing approaching drivers to lower their speed. Select plantings to ensure adequate sight distance for the life of the project by considering future maintenance

as well as current design requirements. Avoid large, fixed landscaping (trees, rocks, etc.) near the roadway, especially in areas vulnerable to run-off-the road incidents. Also avoid items in the central island that may be considered an attractive nuisance that may encourage passersby to go to the central island for pictures, or other objects that might distract drivers from the driving task. Consider the salt tolerance of any plant material, as well as snow storage and removal practices. In addition, landscaping that requires watering may increase the likelihood of wet and potentially slippery pavement. Where possible in urban areas consider installing a frost proof water supply and electrical supply to the central island primarily to address maintenance.

The slope of the central island is not to be steeper than 6:1. As an absolute minimum, keep the outside 6 feet of the central island free from landscape features to provide a minimum level of roadside safety, snow storage, and unobstructed sight distance.

Where truck aprons are used in conjunction with a streetscape project, construct a roadway pavement that is consistent with other streetscape elements. However, the material used for the apron should be a different color or texture than the material used for the sidewalks to discourage pedestrians from crossing the circulatory roadway. Avoid street furniture that may attract pedestrian traffic to the central island, such as benches, decorative statues, community welcome signs, or monuments with small text. If fountains or monuments are being considered for the central island, they must be designed in a way that will enable proper viewing from the perimeter of the roundabout and not distract drivers. In addition, they must be located and designed to minimize the possibility and severity of impact from an errant vehicle.

Splitter Island and Approach Landscaping

Low to the ground landscaping in the splitter islands and the approaches can benefit both public safety and enhance the visual quality of the intersection and the community. In general, unless the splitter islands are very large, they must not contain trees, planters, or light poles. Avoid landscaping which will obstruct sight distance, as the splitter islands are usually located within the critical sight triangles.

Landscaping on the approaches to the roundabout can enhance safety by making the intersection more conspicuous and by countering the perception of a high-speed through traffic movement. Avoid landscaping within 50 ft in advance of the yield point. Plantings in the splitter islands (where appropriate) and on the right and left side of the approaches (except within 50 ft of the yield point) can help to create a funneling effect and induce a decrease in speeds approaching the roundabout. Low profile landscaping in the corner radii can help to channelize pedestrians to the crosswalk areas and discourage pedestrian crossings to the central island.

Maintenance

See [Chapter 27](#) for guidance on maintenance requirements for landscaping.

Work Zone Traffic Control

During construction, traffic control by police and/or construction personnel (i.e. flagging) may be needed. Space channelizing devices so that the motorist, bicyclist, and pedestrian have a clear indication of the required travel path and turning radii. This may require closer spacing than the MUTCD would otherwise specify. Standard detail drawings 15D21 and 15D31 show example device spacing at turning radii and curve transitions. Evaluate traffic control needs for each roundabout installation on a site-specific basis until the Department develops the expertise in roundabout construction to provide guidance.

Pavement Markings

Because of the confusion of a work area and the change in traffic patterns, pavement markings must clearly show the intended travel path. Misleading pavement markings shall be removed or covered in accordance with the *Wisconsin Standard Specifications*. As new pavement courses are placed consider specifying in the plans that splitter island delineation and broken white lines on the outside edge of the circulatory roadway be marked the same day the pavement course is placed according to *Wisconsin Standard Specifications*. When pavement markings are not practical, or misleading markings cannot be adequately deactivated, use closely spaced channelizing devices to define both edges of the travel path. Also, specify that the inner edge of the circulatory roadway shall be delineated either by short term pavement markings consisting of an 8-inch wide solid yellow line or reflective channelizing devices at 50-foot spacing or less.

Signing

Construction signing for a roundabout should conform to the MUTCD. Provide all necessary signing for the efficient movement of traffic through the work area, including pre-construction signing advising the public of the planned construction, and any regulatory and warning signs necessary for the movement of traffic outside of the immediate work area. The permanent roundabout signing may be installed, where practicable, during the first construction stage so that it is available when the roundabout is operable, but these signs must be covered until they are needed. Consider using portable changeable message signs when traffic patterns change.

Lighting

Illuminate the temporary construction area through the intersection where possible. Consider adjacent lighting conditions, traffic volumes during the evening when the roundabout is illuminated, and mixture of use such as pedestrians and trucks.

Construction Staging

Carefully consider construction staging during the design of the roundabout, especially if it must be built under traffic. As is the case with any construction project, install appropriate traffic control devices as detailed in the project plans and the Standard Specifications. This traffic control shall remain in place as long as it applies and be removed when it no longer applies to the condition.

Prior to the work that would change the traffic patterns to that of a roundabout, certain peripheral items may be completed including permanent signing (covered), lighting, and some pavement markings that reflect actual conditions. These items, if installed prior to the construction of the central island and splitter islands, would expedite the opening of the roundabout and provide additional safety during construction.

It is desirable to complete construction as soon as possible to minimize the time the public is faced with an unfinished layout or where the traffic priority may not be obvious. If possible, all work, including the installation of splitter islands and striping, should be done before the roundabout is open to traffic.

If it is necessary to leave a roundabout in an uncompleted state overnight, construct the splitter islands before the central island. Any portion of the roundabout that is not completed must be marked, delineated, and signed in such a way as to clearly outline the intended travel path. Remove or mask pavement markings that do not conform to the intended travel path.

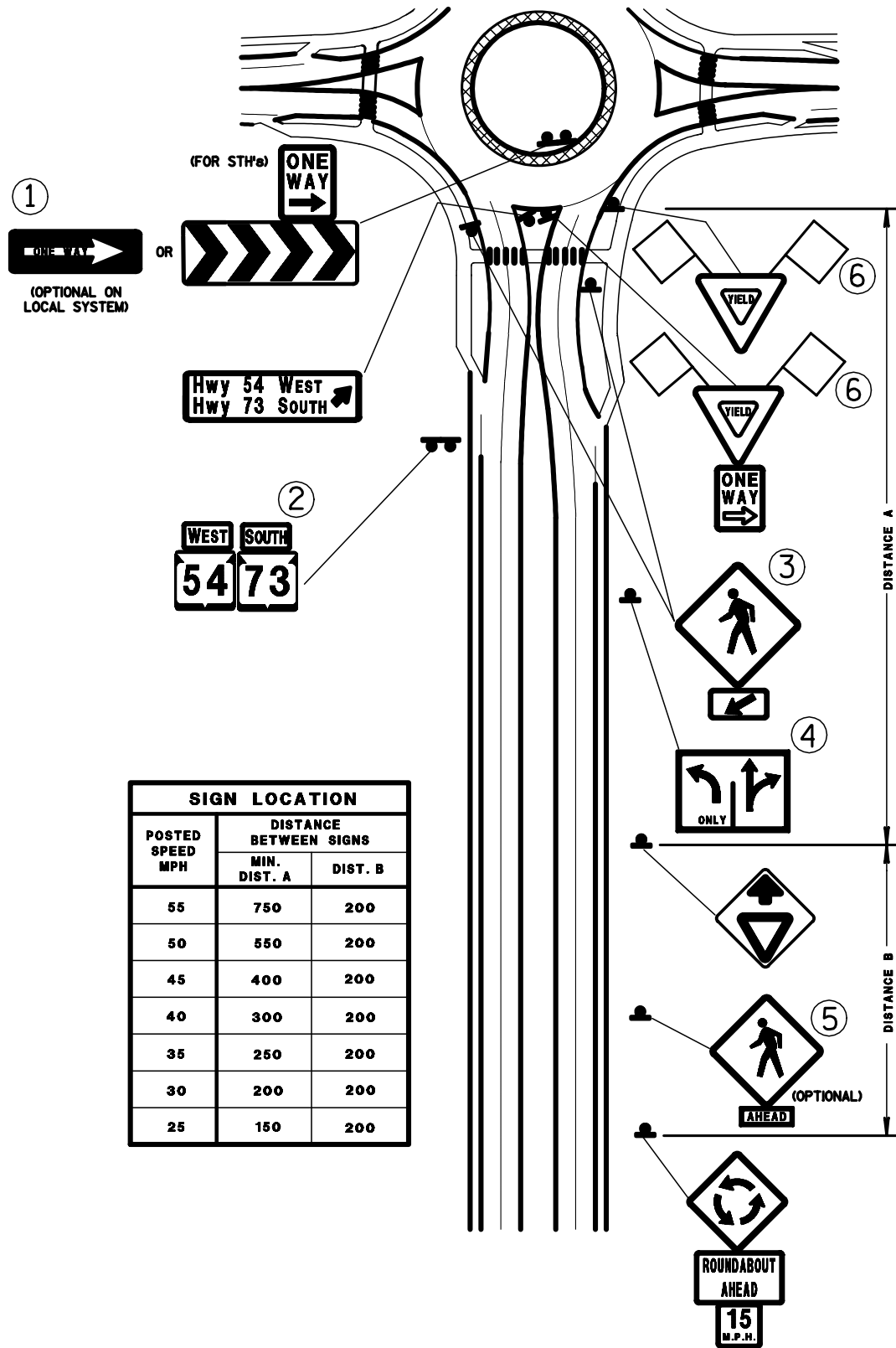
Consider detouring traffic away from the intersection during construction of the project. A detour will significantly reduce the construction time and cost and will increase the safety of the construction personnel. If it is not possible to detour all approaches, detour as many approaches as possible and stage the remainder of the construction as follows unless a different staging plan is approved during design:

1. Install and cover proposed signing.
2. Construct outside widening if applicable.
3. Reconstruct approaches if applicable.
4. Construct splitter islands and delineate the central island. Uncover the signs at this point and operate the intersection as a roundabout.
5. Finish construction of the central island.

Public Education

Advise the public whenever there is a change in traffic patterns. Education and driver awareness campaigns are especially important for a roundabout because a roundabout will be new to most motorists. Provide brochures on how to drive, walk and bicycle through a roundabout. The following are some specific suggestions to help alleviate initial driver confusion.

- Hold public information meetings prior to construction.
- Prepare news releases/handouts detailing what the motorist can expect before, during, and after construction.
- Install portable changeable message signs or fixed message during construction and before construction begins. Advise drivers of anticipated changes in traffic patterns for about one week prior to the implementation of the new pattern.
- Use news media (and Highway Advisory Radio, if available) to broadcast current status of traffic patterns and changes during construction. Also, if appropriate, establish a web site, to post up-to-date traffic and construction information.



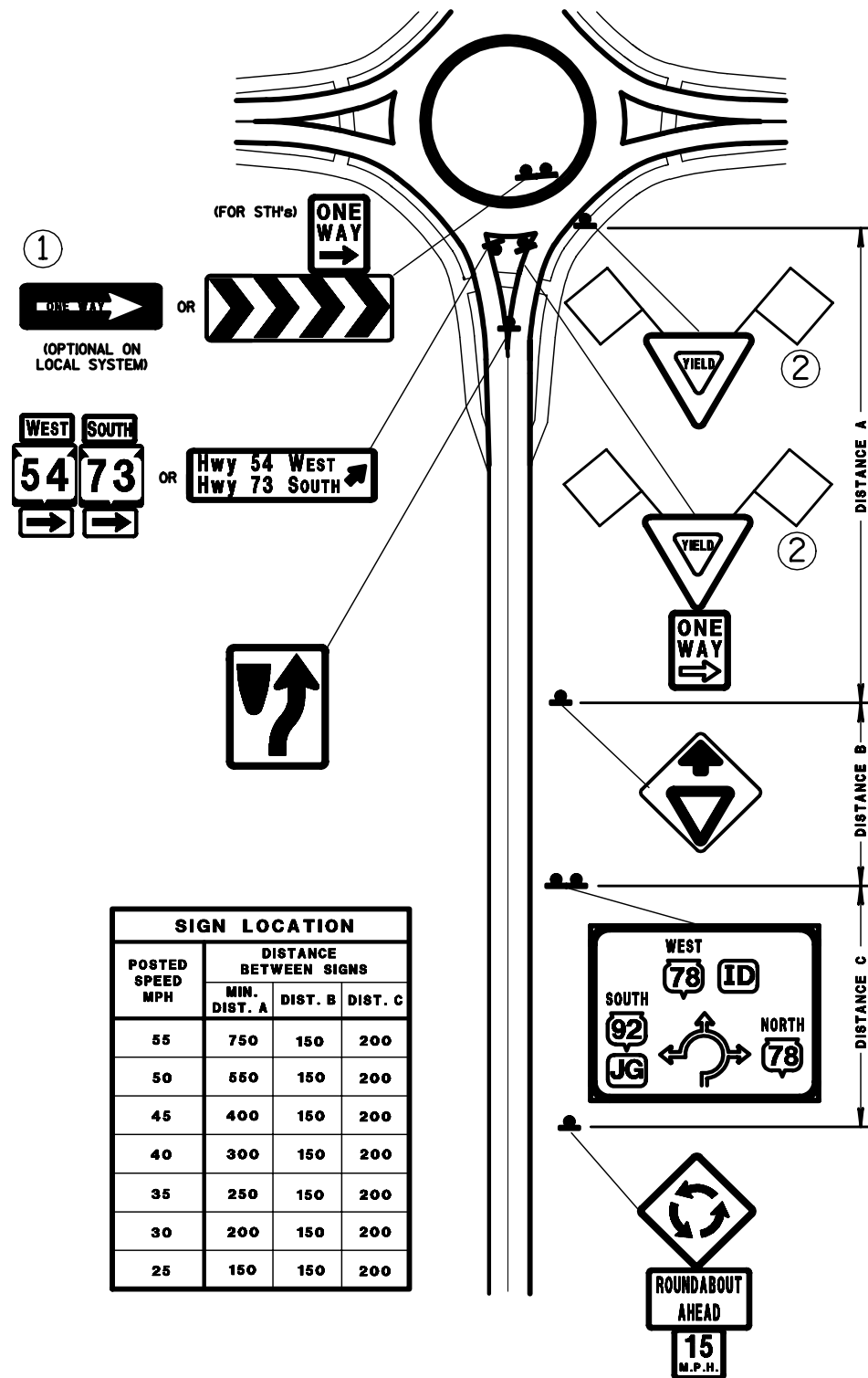
Sample signing plan for an urban roundabout

Figure 1

Notes:

- ① Use the R6-2R ONE WAY sign on STH's. The R6-1R ONE WAY sign may be used on the local system that includes connector highways.
- ② Locate the route confirmation sign just downstream from the roundabout exit where it is visible from within the roundabout, if possible.
- ③ The pedestrian crossing sign should not block the driver's view of the pedestrian.
- ④ Use the standard R3-8, lane assignment, signs on multi-lane roundabout approaches where needed. The modified R3-8 sign, as shown in the Regulatory Signs Section is not acceptable at this time on the STH system.
- ⑤ The pedestrian ahead signing is optional when advance visibility of the pedestrian sign is good. When the advance visibility of the pedestrian sign is poor then the pedestrian ahead sign is recommended.
- ⑥ Install 18" x 18" orange flags on top of the YIELD signs for the first six months of operation of the roundabout to emphasize the yield movement.

Figure 1 – continued



Sample signing plan for a rural roundabout

- ① Use the R6-2R ONE WAY sign on STH's. The R6-1R ONE WAY sign may be used on the local system, which includes connector highways.
- ② Install 18" x 18" orange flags on top of the YIELD signs for the first six months of operation of the roundabout to emphasize the yield movement

Figure 2

